Investigating key determinants of potato flavour and texture

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Background

Sensory traits such as flavour and texture are important factors in consumer preference trials. In order to improve germplasm it is important to increase our understanding of the molecular basis of these traits.

Our studies were based on the comparison of Phureja with Tuberosum tubers. Phureja tubers not only score higher in professional sensory evaluation panels but they also cook more quickly than Tuberosum tubers.

This led us to make comparisons of flavour metabolites from boiled tubers of a range of Phureja and Tuberosum cultivars and investigate differences in tuber texture.

Aims of the project

Understand the factors that contribute to tuber flavour and texture by comparing different potato germplasm.

Exploit this knowledge to understand the metabolic pathways responsible for these traits in order to pinpoint target genes.

Results

Matrix associated umami compounds

The non-volatile matrix associated umami compounds enhance flavour and mouth feel. The major umami compounds present in potato tubers are the amino acids, glutamate and aspartate and the 5’ ribonucleotides, GMP and AMP. The synergistic effect between certain free amino acids and 5’-ribonucleotides can be measured using an equivalent umami calculation (EUC). Previous studies atSCRI have shown that Phureja tubers contain significantly higher levels of umami compounds compared to Tuberosum correlating strongly with acceptability across from sensory evaluation data.

Effect of different storage regimes on tuber umami content

UMAMI compounds were compared in Phureja and Tuberosum tubers during storage of 4 and 10°C.

- EUC values are significantly higher in Phureja cultivars compared with Tuberosum cultivars at harvest.

- However, after three months of storage at 4°C and 10°C, there was no significant difference in the EUC values for the Phureja and Tuberosum tubers.

Texture related gene expression analysis

Major differences in the expression levels of genes involved in cell wall biosynthesis (and potentially texture) were also identified by microarray analysis including genes encoding pectin methyltransferase and pectin acetylesterase. Quantitative PCR assays were performed to confirm the microarray expression patterns.

Enzyme activity of pectin methyltransferase was measured using an assay at gelatinase assay. PME activity was consistently higher in Tuberosum compared with Phureja.

Transgenic plants overexpressing the PME gene exhibit a firmer texture compared with wild type controls whereas antisense lines had a softer texture.

Summary

Significant and consistent differences in both non-volatile and volatile components were detected and we hypothesise that these compounds underpin the preferred flavour of Phureja. We are currently aiming to understand the metabolic pathways by which these compounds are made in order to pinpoint target genes.

Major differences in the expression levels of genes involved in pectin modification were also identified and are currently being tested by transgenics. A genetic approach is currently being used to identify quantitative trait loci (QTL) associated with tuber quality.

References


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